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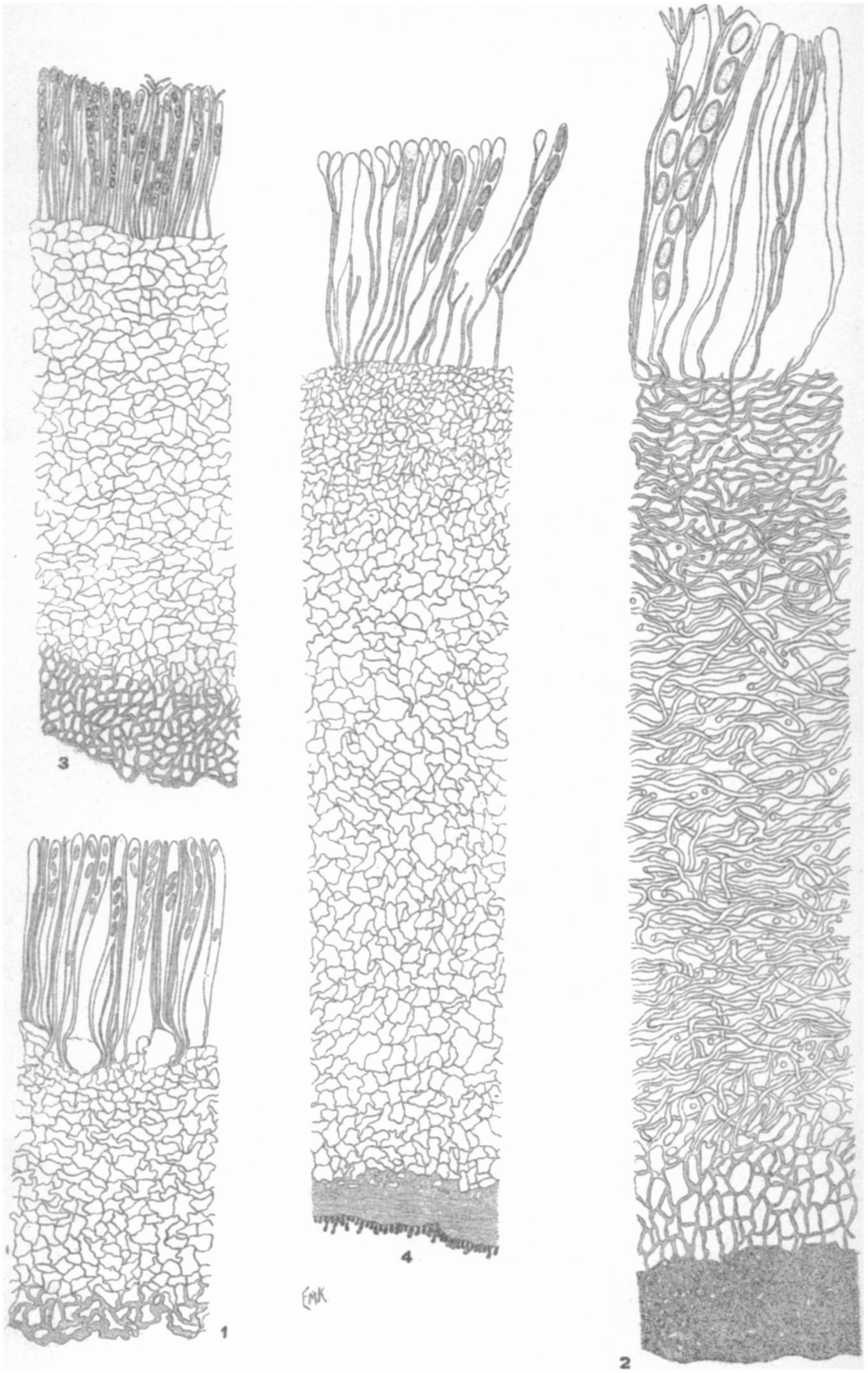

URNULA, GEOPYXIS AND CHORIOACTIS

Studies on Urnula and Geopyxis

By Elsie M. Kupfer

(With Plate 8)

The apparent confusion in which the genus *Urnula*, as treated by various authors seemed to stand, and the belief that an examination of the anatomical structure might lead to some conclusions as to the relationships of the various species included under this name, led the writer to the present investigation. The results reached in the paper are threefold: (1) The reestablishment of the genus *Urnula* upon its proper footing; (2) The determination of the relationship of the genera *Geopyxis* and *Urnula*; and (3) The establishment of a new genus *Chorioactis* allied to *Plectania* in the family Pezizaceae.

The excellent work of Dr. E. J. Durand on the Pezizineae has laid down the lines which investigation in such work must take; and it was the purpose of the writer to follow as closely as was feasible Dr. Durand's plan and method. Of necessity, the study was made entirely from dried material, which, while satisfactory in most respects, left something to be desired in one or two instances. The specimens were soaked up for a day in a mixture of equal parts of glycerine, alcohol, and water, then dehydrated and embedded in paraffin. The sections 3–10 μ in thickness were taken from the center of the cup, and were stained with haemalum. The tissue drawings were outlined with a camera lucida.

The genus *Urnula* was founded by Fries in 1849* on *Peziza Craterium* Schweinitz.† Fries' description of the genus was as follows: "*Excipulum coriaceum, inflatum, inane, clausum dein ore rotundo rimose dehiscens. Discus latera interiora vestiens sporis moniliformi-seriatis intermixtis paraphysibus superficiales byssisedae.*" Although the characters noted by Fries are, naturally, mainly external, there can be no doubt as to the limitation of the genus, since Fries mentions the type on which he originated it, which since the publication of Schweinitz' figure has been well known.

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* Summa Veg. Scand. 2: 122.

† Syn. Fung. Car. sup. 9. *pl. 1. f. 7–11.*

During the next forty years three additional species were placed in the genus—*U. minor* Fries, 1855, from Guinea, *U. Hartii* Berk. from Greenland and *U. Microcrater* (Hazs.), from Hungary. As no material representing these species was available they are left out of consideration in the present article.

In 1889 Saccardo compiled descriptions of the existing species and added as a fifth, *U. terrestris* (*Podophacidium terrestre* Niessl). Saccardo's description of the genus was broad enough to include all five species.*

Rehm in his "Discomycetes" 1896 † perceiving a lack of relationship among the species of Saccardo, did what must be considered an utterly unwarranted step. Taking away from *Urnula* the type *Urnula Craterium* on which Fries had founded the genus, he reserved the generic name for the single species, *U. terrestris*, apparently unrelated to the former fungus; so that Rehm has a genus *Urnula* consisting of a single species which has no resemblance to the type of Fries, and which accords in but a very general way with the Friesian description. *Urnula Craterium* he transfers to *Geopyxis*. It may be mentioned here parenthetically, that Lindau's treatment in Engler-Prantl ‡ need not be specially considered as he has adopted almost entirely Rehm's views and classification.

A letter to Dr. Rehm asking the reason for his transfer received a somewhat unsatisfactory reply. He answered that *Urnula Craterium* was placed with its *related species* under *Geopyxis*, because *Geopyxis* was established by Persoon before *Urnula* by Fries; and that in order to retain the genus *Urnula*, under which Saccardo had placed *Podophacidium terrestre* of Niessl, he (Rehm) restricted the genus to this latter fungus. The two most essential points, however, were not answered. Why *Urnula Craterium* should be regarded as allied to *Geopyxis*, or why, except that Saccardo had placed it there, *Podophacidium terrestre* should be considered an *Urnula* are points left unexplained. On this latter point, indeed, Rehm has now serious doubts as will appear later; so that his present opinion seems to be that the genus *Urnula* must disappear entirely.

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* Sylloge Fungorum, **8**: 548 *seq.*

† Rabenhorst, Krypt. Flora, **1**: 971.

‡ Die natürlichen Pflanzenfamilien, **1**: 172–242, 253.

The genus *Geopyxis* was, as Rehm says, originated before *Urnula*. Persoon established it as a subgenus of *Peziza* about 1822.* As I understand his arrangement (which is somewhat obscure owing to errors in the synopsis), Persoon included forty-three species under the group *Geopyxis*. Of these, five, *G. carbonaria*, *G. micropus*, *G. bufonia*, *G. Catinus* and *G. verrucosa* still remain in the genus as described by Rehm. A comparison, then, of one of these forms with *Urnula Craterium* should show in how far the latter is allied to *Geopyxis* and by what right Rehm has placed Schweinitz' plant in this genus. For the purpose of this comparison *G. carbonaria* was chosen.

We have then to consider, by a study of external structure and internal anatomy, the relationships of these various fungi, *Gropyxis carbonaria*, *Urnula Craterium*, and *Urnula terrestris*. One other will come up for consideration. In 1891 Professor Underwood discovered a new fungus in Austin, Texas, which was sent to Professor Peck for identification. Peck described this in the forty-sixth report of the state botanist as *Urnula Geaster*. A doubt suggested by Professor Underwood as to the correctness of this generic reference was the direct occasion of this study, which was carried on under his guidance.

1. *Geopyxis carbonaria* (Alb. & Schw.) † is a small, fleshy fungus yellowish in color, and, at the most, 2 cm. in diameter. It is short-stalked, the stalks being 1–1.5 mm. long and 1–2 mm. wide. It is well figured in Cooke's Mycographia *pl. 74, f. 284.* An examination of the internal anatomy of *G. carbonaria* (*pl. 8, f. 1*) shows it to be a true member of the Pezizaceae and of *Geopyxis* according to Durand. The excipulum is entirely pseudoparenchymatous, the asci form a uniform layer, the stem is short and externally even—all of which points correspond to Durand's synopsis of this family and genus. In this *Geopyxis* the hypothecium is not particularly differentiated from the excipulum except by the smaller size of the cells. At the limiting border of the excipulum there are thicker walled cells, slightly darker in color. The cells of the excipulum average 14 μ in diameter; those of the hypothecium, 9 μ. The asci are about 170 μ long and 7–8 μ wide. The spores are 10–11 μ long and 3–4 μ wide.

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* Mycol. Europaea, 1: 224–242.

† Conspectus Fungorum in Lusatiae sup. 314. *pl. 5. f. 2.* 1805.

2. *Urnula Craterium* (Schw.) Fr. (*Geopyxis Craterium* Rehm.) This is a large leathery fungus 3–7.5 cm. wide, often over 7 cm. high, with a stalk 5 cm. long and sometimes 2 cm. broad. Even externally the fungus does not closely answer Rehm's own description of the genus *Geopyxis* under which he places it; the texture of the apothecium is described as fleshy, the stem, as short and sometimes thin; while in this plant, the leathery character of the cup and the length and thickness of the stem are its noticeable features; one of its most characteristic points is the dense black tomentum which serves as a hypothallus. The hypothallus in *G. carbonaria*, on the other hand, is very inconspicuous. The difference in the size of the asci and spores is also a point worthy of mention in the contrast between the two forms; the asci in *U. Craterium* are 430 μ long and 12 μ wide; the spores, 25–30 μ long and 8 μ wide. The asci in this fungus then are more than twice as long and the spores nearly three times as large as in the *Geopyxis.* But ignoring these facts, a comparison of the internal anatomy of the two forms will, I think, dispel all illusions as to their relationship. In *fig. 2* is represented a cross section of *U. Craterium.* The excipulum is seen to be divided into two distinct layers. At the outside, next to the limiting membrane, there are a few rows of rather regular polygonal cells; but the great mass of the excipulum and hypothecium is prosenchymatous, *i. e.*, made up of long non-septate interwoven hyphae giving an exceedingly fibrous appearance to the whole tissue. The hypothecium is differentiated from the medullary portion of the excipulum by the closer mesh and smaller diameter of the hyphae of which it is composed. It is about one fourth the width of the whole sterile part.

Urnula Craterium, then, belongs to a totally different genus from *Geopyxis carbonaria* and must be restored as the type of the genus *Urnula* as Fries founded it. Indeed there are very strong reasons, as will be seen shortly, for placing it in an entirely distinct family from *Geopyxis*, so that the inclusion of the two fungi under the same genus appears almost absurd.

3. *Urnula terrestris* (Niessl) * Sacc. This is a small rather leathery fungus 2–3 mm. in diameter with a very short stalk. Copies

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* Verh. Naturf. Ver. Brünn, 10: 63. 1872.

of Niessl's figures are given in Rehm, *l. c.* 990. The asci are about 124 μ long and 6 μ wide ; the spores, 11–12 μ long and 4–5 μ wide. The cross section of *Urnula terrestris* (*fig. 3*) shows that here again there is no relation whatever with *Urnula Craterium ;* the tissue is entirley pseudoparenchymatous, the excipulum being composed of two layers. The few outer rows are composed of cells about 11 μ in diameter with thick brown walls. The rest of the tissue is undifferentiated, so that we may call it excipulum with no marked hypothecium, or all hypothecium, restricting the term excipulum to these few rows of cells on the outside. Whatever we may call it, its character definitely separates it from a structure such as is found in *Urnula Craterium.* An additional fact pointing to the separation of the two species is one to which both Rehm and Lindau attach great importance in classification. Iodine colors the ascopores of *U. terrestris* blue, but does not those of *U. Craterium.*

Urnula terrestris as defined by Saccardo then, is not an *Urnula.* Niessl, in 1872, named the fungus *Podophacidium terrestre,* so that this old generic name, at least, we must restore. A point of interest, however, arises with regard to its specific name. In 1885 Boudier* established a genus *Melachroia* on *Peziza xanthomela* Pers. Schröter was the first to suspect the identity of the two fungi and called them *Podophacidium xanthomelan.* Rehm in his classification separates them, because the apothecium in *Urnula terrestris* splits into lobes, while in *Melachroia xanthomela* it remains nearly entire. In the letter before mentioned, however, Dr. Rehm says that he has no longer the least doubt that the two fungi are one and the same thing, and that the condition of the margin of the apothecium in *Urnula terrestris* is due merely to local conditions of growth. This view is substantiated by a comparison of the anatomy of the two forms. Dr. Rehm kindly sent specimens of both fungi which were sectioned as described above. The representation of *Urnula terrestris* (*fig. 3*) would do equally well for *Melachroia xanthomela;* the only difference revealed by the closest investigation was that the outer excipular portion was slightly thicker in the former fungus. This, however, may be regarded as purely accidental and of no significance. Consequently we must adopt Schröter's nomenclature, and consider both *Urnula terrestris* and *Melachroia xanthomela* under the name of *Podophacidium xanthomelan.*

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* Bull. Soc. Myc. 1 : 112.

Since, then, the internal structure is very different from *Urnula Craterium,* and the splitting of the margin into lobes, which was Saccardo's chief reason for regarding this species as an *Urnula,* is an uncertain character, any relation between the two genera is seen to be absolutely unreal. To quote Dr. Rehm: "Dann schwindet allerdings die Verwandschaft mit *Urnula* Fr. völlig, und ist den zusammengehörigen beiden Pilzen eine andere systematische Stellung zu geben."

It might be well at this point, before the consideration of the next species, to decide what systematic position is to be assigned to the two species *Urnula Craterium* and *Podophacidium xanthomelan.* From the character of its tissue, the latter seems to belong in the Pezizaceae. Owing to the fact that the ascopore turns blue with iodine, and that the fungus is stalked, its affinities seem to be with *Tarzetta* and *Plicaria* in this family.

As to *Urnula Craterium,* it is my belief that it is to be placed among Saccardo's Dermateae or in the family Cenangiaceae following Lindau; the leathery texture of the apothecium, the prosenchymatous tissue and well developed hypothecium indicate this as its proper position. Whether or not a definite epithecium is present, as in most of the members of this family, could not be decided from sections of the dried specimens. The paraphyses do not seem to endure drying well, and were difficult to make out; so that these are represented (*fig. 2*) as somewhat reconstructed, and very probably do not quite accurately reproduce the condition in the fresh specimen. Even if an epithecium should prove absent, however, the Cenangiaceae appear to me to be the most satisfactory position, and, indeed, the only place for the fungus.

4. **Chorioactis Geaster.** (*Urnula Geaster* Peck.)* Finally we come to the species which was called by Peck *Urnula Geaster,* and which, since it is not an *Urnula,* I propose to call *Chorioactis.* This is a very large leathery fungus from 4–7 cm. in diameter, narrowed to a stem about 3 cm. long and 1–1.5 cm. thick. The apothecium splits into 4–6 rays, giving the plant an appearance

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* Reg. Rep. **46**: 39. 1893.

very similar to a *Geaster*, so that Peck's specific name is an appropriate one. Both disc and stem are covered on the outside with a dense tomentum of soft brown hairs. The thickness of the apothecium is a striking characteristic; it sometimes reaches 2.5 mm. The outer layer of the apothecium is dark brown, the hymenium and flesh yellowish white; the asci are very large, 670 μ long; the spores are 49–60 μ long by 12–16 μ wide. The *Geaster*-like appearance of this fungus, the tough, leathery texture, the thickness of the disc, and the velvety tomentum which clothes the whole surface make of it an exceptionally characteristic and easily distinguishable genus and species. That it is not an *Urnula* seems to me just as evident from its external appearance as from an examination of its tissues. A comparison of internal characters shows, however, that there is no possible relation with *Urnula Craterium*. The tissue is made up wholly of large parenchymatous cells; those of the excipulum averaging 34 μ in diameter, those of the hypothecium 10–14 μ. The relative size of the cross sections of the various forms discussed can be seen from the fact that the sections of *Chorioactis Geaster* are magnified only thirty-five times, while all the others were magnified about two hundred times.

As to the position of *Chorioactis*, its entirely parenchymatous tissue will at once place it among the Pezizaceae. Following out Durand's scheme, its stipitate character, the tomentum and its elliptical spores indicate a relationship with *Plectania* and *Sarcoscypha* in this family. The genus *Chorioactis* will probably prove the most leathery in the whole family, but a comparison with *Sarcoscypha* and *Otidea* in this respect shows that among the Pezizaceae are to be included all gradations from a most fleshy brittle character, as in the majority of pezizaceous forms, to a texture as tough and leathery as that in the Cenangiaceae and other families.

To sum up briefly, then, the points brought out in this paper:

1. *Urnula Craterium* Fr. represents an entirely distinct genus not in any way related to *Geopyxis*. It is very probably to be placed in the family Cenangiaceae while *Geopyxis* is a member of the Pezizaceae.

2. *Urnula terrestris* (Niessl) Sacc. is not at all allied to *U. Craterium* and must consequently be removed from this genus. It is iden-

tical with *Melachroia xanthomela* Boud. and, following Schröter, must be called *Podophacidium xanthomelan.* Its position appears to be near *Tarzetta* in the Pezizaceae.

3. *Urnula Geaster* Peck forms a new genus, *Chorioactis*, distinct from *Urnula* and from all the other genera mentioned in this article. **Chorioactis Geaster** (Peck) seems to belong near *Plectania* and *Sarcoscypha* in the Pezizaceae.

Explanation of Plate 8

The illustrations were drawn from a magnification about two and one half times the reproduction appearing in the plate.

FIG. 1. Cross section of *Geopyxis carbonaria*, × 200.
FIG. 2. Cross section of *Urnula Craterium*, × 200..
FIG. 3. Cross section of *Podophacidium xanthomelan*, × 200.
FIG. 4. Cross section of *Chorioactis Geaster*, × 35.